KENTUCKY TRAUMATIC BRAIN INJURY PILOT PREVALENCE STUDY

PRELIMINARY FINDINGS
February 2003

Prepared For

The Kentucky Traumatic Brain Injury Trust Fund Board

And

The Kentucky Department of Mental Health and Mental Retardation,
Brain Injury Services Unit,
Colleen A. Ryall, Ed.D., Director

***Report Prepared by*:**
Robert Walker, M.S.W., L.C.S.W., Assistant Professor
TK Logan, Ph.D., Assistant Professor
Carl Leukefeld, D.S.W., Professor and Director
Tom Jackson, Ed.D.

Center on Drug and Alcohol Research
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10 February 2003

Governor Paul E. Patton
Commonwealth of Kentucky
Capitol Building
Frankfort, Kentucky 40621

Dear Governor Patton:

This preliminary report on the prevalence of brain injuries among Kentucky households is a first step for the TBI Trust Fund Board in getting a better understanding of the scope of the problem in Kentucky and what services are needed for persons with brain injuries.

Kentucky is among the first states in the nation to undertake a prevalence study of brain injury, and we think that our continuing effort to develop prevalence estimates will result in important and valid findings over the next year. This preliminary report provides results from the first wave of households that have been interviewed in a telephone survey conducted by the University of Kentucky.

Our Board wanted to share this report with you in the hopes that the planning efforts concerning persons with brain injuries will benefit from the new data.

Sincerely yours,

Mary Hass,
Chairperson
Traumatic Brain Injury Trust Fund Board

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KENTUCKY TRAUMATIC BRAIN INJURY PILOT PREVALENCE STUDY
PRELIMINARY FINDINGS

EXECUTIVE SUMMARY

Kentucky is one of the first states in the country to begin studying the prevalence of brain injury among its residents. These preliminary findings from the KENTUCKY TRAUMATIC BRAIN INJURY PILOT PREVALENCE STUDY suggest that Kentucky has many residents with a history of brain injuries and that health service planning should include awareness of persons who have survived brain injury as well as their associated service needs.

From a survey of 1616 households through the first week of January 2003 we conclude that:

- ***Almost one-fifth of Kentucky households (19.9%) report having at least one member with a history of a brain injury***
- ***There were no significant regional differences in the rate of households reporting persons with brain injuries***
- ***Almost two-thirds (62.3%) of the injured persons were male***
- ***Motor vehicle accidents are the leading cause of the reported injuries (33.5%)***
- ***Over half (59.8%) of the injuries were reported to have occurred before age 21***
- ***Almost half (44.1%) of those who were reported as having a brain injury lost consciousness as a result of the injury***
- ***Over three-fourths (84.2%) of the injured persons were taken to a hospital emergency department***
- ***Almost half (41.6%) of the injured persons were hospitalized for at least one night following the injury***
- ***Almost one-fourth (21.6%) experienced increased depression after the injury***
- ***Almost one-fourth (22.8%) experienced increased anxiety after the injury***
- ***Almost one-third (32.6%) were reported needing professional services following this injury***

KENTUCKY TRAUMATIC BRAIN INJURY PILOT PREVALENCE STUDY
PRELIMINARY FINDINGS

Introduction

This study was funded by the Kentucky Traumatic Brain Injury (TBI) Trust Fund Board pursuant to one of its statutory mandates. KRS 211.470 established the TBI Trust Fund Board to administer funds as a payer of last resort for persons with brain injuries who need services that are not covered by existing insurance or other private or governmentally funded programs. Kentucky law mandates the TBI Trust Fund Board to fund the cost of ten key services that meet the needs of persons with brain injuries. Also among the statutory mandates of the Trust Fund are provisions for investigating the needs of persons with brain injuries and identifying gaps in current services for persons with brain injuries. In addition, there is a mandate to assist the Cabinet for Health Services, Department of Mental Health and Mental Retardation to develop programs for persons with brain injuries. In order to meet the requirement for examining the needs of persons with brain injury and to assist in developing services, there is a need for information about the scope of the brain injury problem in Kentucky. Kentucky is not alone in this need for information. In fact, most states in the nation are developing services for persons with brain injuries and are, as a result, seeking data about the scope and prevalence of brain injury among their residents. However, to date, it does not appear that any state has developed brain injury prevalence information by surveying households. Most states are developing incident surveillance mechanisms to identify brain injury incidents for prevention and other health planning purposes.

Consistent with the identification of service needs and the scope of brain injury problems among Kentucky residents, the TBI Board is mandated to implement a registry of individuals who incur brain injuries. These data are obtained from hospital trauma centers and are based on discharge data for each person admitted with a diagnosis of an acquired brain injury. These data, while very important in identifying new incidents of brain injury, do not help in estimating the full scope of the problem of brain injury among Kentuckians. Incident data only identify injury events, and, given the hospital source of the data, only the most severe injuries can be identified. Incident data are collected from discharge information from trauma centers and a few other participating hospitals. By relying on hospital discharge data, mild brain injuries that did not result in a hospital stay are not reported.

Due to improved emergency medical services, which include helicopter transport to specialized trauma centers, improved medical and surgical interventions, and improved rehabilitation services, more people are surviving brain injuries now than in the past. However, improved emergency treatment means that there is an ever increasing number of persons with a history of brain injury. While incidence reporting identifies new cases of brain injury, it does not provide data to estimate the number of

Kentuckians with brain injuries. Obtaining information about the prevalence of brain injury is important for health planning and the development of services for injured persons. The decision to carry out a prevalence study of brain injury was made by the TBI Board after examining the findings from its two previous years data on incidence from trauma centers and other national trauma databases (Christian, 2001; 2002). The 1998 trauma center data include findings of 1,573 persons with acquired brain injury (ABI) or 40 per 100,000 of the Kentucky population (Christian, 2001). The FY 2002 report shows a total of 3,038 acquired brain injury events for a per 100,000 rate of 76.7 (Christian, 2002). The Board was concerned that many persons with brain injuries do not receive trauma center services and are not accounted for. While one study has examined the household prevalence of brain injury incidents in the past 12 months, it did not address prevalence of a history of brain injury among household members (Sosin, Thurman & Sniezek, 1996). The TBI Board's concern was about the number of persons accrued each year with a brain injury and the scope of the problem among the general Kentucky population.

This pilot study is being carried out under a contract by the Department of Mental health and Mental Retardation with the University of Kentucky Center on Drug and Alcohol Research (CDAR). CDAR has a twelve year history of federal and state-funded research in Kentucky on substance abuse, violence, mental health problems, and other behavioral health problems. The Center has also conducted three needs assessment projects that include household surveys to estimate the prevalence of substance use disorders among the general population.

Background

Traumatic brain injury, which can result in death, disability and long-term changes in quality of life, is clearly a significant health problem in the United States (Thurman, Alverson, Dunn, Guerrero & Sniezek, 1999). Data from the Centers on Disease Control (CDC) suggest that approximately 50,000 U.S. residents die as a result of traumatic brain injury (TBI) each year. Persons who survive an incident of brain injury often experience neuropsychological problems that result in disabilities affecting work, schooling, educational progress, training, and/or socialization (Adekoya, Thurman, White & Webb, 2002). For example, during the period from 1979--1992, Traumatic brain injury-related death rates in the United States declined by 22%, from 24.6 to 19.3 deaths/100,000 population (Adekoya, et al., 2002). However, traumatic brain injury still represents a major cause of morbidity and mortality in the United States (Thurman, Jeppson, Burnett, Beaudroin, Rheinberger, Sniezek, 1996). Each year, TBI-related deaths represent more than one-third of all injury-related deaths (Adekoya, et al., 2002). Survivors of moderate to severe injuries often require extensive rehabilitation services and even long-term care while those with mild injury can experience life-changing problems that are often difficult to treat (Luchter & Walz, 1995). For example, in 1995, the total direct and indirect financial costs of traumatic brain injuries were estimated at $56 billion (Thurman, 2001).

The Federal Interagency Head Injury Task Force identified traumatic brain injury as a critical public health problem in 1989 (DHHS, 1989). In 1995, the CDC developed guidelines for surveillance of TBI (Thurman, Sniezek, Johnson, Greespan & Smith, 1995) and, with funding authorized under Public Law 104-166 (the Traumatic Brain Injury Act of 1996), the CDC supported the development of a multi-state TBI surveillance system (Adekoya, 2002). Additional population-based epidemiologic studies of TBI are needed to assess trends in etiologic factors, to provide additional guidance for public policy, and to develop and evaluate brain injury prevention strategies. Despite the decline in fatal TBI incidents, traumatic brain injuries remain a significant challenge for public health and mental health planners. Previous household surveys of brain injury have focused on brain injury events that occurred in the past 12 months rather than the presence of a history of brain injury among members of the household (Sosin, et al., 1996).

One of the elements often missed in brain injury surveillance is mild traumatic brain injury. Mild injuries often do not result in hospitalization and may even receive no medical attention. The National Health Interview Survey, updated to the 1990 census, estimated there are about 1,975,000 head injuries each year in the United States (Collins, 1990) and from 300,000 – 525,000 persons are hospitalized each year for brain injuries (Guerrero, Thurman & Sniezek, 2000; Krause & Sorenson, 1994). However, from half to three-quarters of these hospitalizations are estimated to be for mild traumatic brain injury (National Institutes of Health 1999; Silver & McAllister 1997; Kraus & Sorenson 1994). In addition, about

half of the mild brain injury cases receive no medical care or only outpatient treatment (Torner, Choi & Barnes 1999). Thus, mild brain injury poses a special identification problem since the acute and chronic sequelae such as memory deficits may be less immediately observable. In fact, memory deficits and associated attentional problems are not always associated with severe and overt brain injury, but can result from mild to moderate injury even when there is no loss of consciousness (Kelly 1999; Malec 1999; National Institutes of Health 1999; Dixon, Taft & Hayes 1993). The recent attention to mild traumatic brain injury (Malec, 1999) points to the need to examine brain injury in the general population rather than among trauma center clinical populations.

Traumatic brain injury has been associated with alcohol and drug use both as a contributing factor to the injury and as a complicating factor for rehabilitation (Hestad et al. 1995; Miller 1992; Boyle, Vella & Moloney 1991). For example, blood alcohol concentrations have been reported in one half of brain injury victims (Kraus et al. 1989) and up to two-thirds of brain injury cases have histories of substance use before the injury (Corrigan 1995). The high prevalence of drug and alcohol problems among traumatic brain injured individuals suggests that substance abusers might be at high risk for brain injury and vice versa. Drug and alcohol use prior to brain injury also can contribute to severity as measured both by coma ratings and by neuropsychological measures (Kelly et al. 1997; Miller 1992; Solomon & Sparadeo 1992; Sparadeo, Strauss & Kapsalis 1992; Sparadeo & Gill 1989).

There is also a need to examine brain injury in rural as well as urban areas. Kentucky brain injury estimates are critical in order to evaluate and plan for future service needs and to improve the availability and quality of community based services in a state that includes a large rural population. Kentucky is one of only 15 states in which more than one-half (55%) of residents live in non-metro areas and almost two-thirds of residents live in places with less than 25,000 people. Kentucky has 120 counties and a 2000 population of 4,041,769 persons (U.S. Census, 2000) living in a state of 39,679 square miles for an average population density of 101.8 persons per square mile. Kentucky's population is predominantly white with 90.7% reporting white only as race in the 2000 census and 7.3% as African American only and 2.6% as other or combinations of race (U.S. Census, 2000). The population is 48.9% male and 51.1% female with 97.2% of persons living in households. Average household size is reported at 2.47 persons. Seventy-four point one percent of Kentuckians 25 years or older have a high school diploma or GED and 15.8% live in poverty. Over 30% of Kentuckians smoke tobacco, 67.7% lack physical exercise, 34.5% do not use seat belts, and 31.8% are overweight as reported in the Kentucky Behavioral Risk Factor Surveillance Study for 1995-1997 (Kentucky Cabinet for Health Services, 2002). Kentucky plans for mental health, mental retardation, and substance abuse treatment services in the context of the 14 regional mental health centers that are defined in Kentucky statute (KRS 210) as regional planning authorities and service providers. The regions vary significantly in population size (from just over 55,000

to almost 900,000) and urban/rural composition. There are three largely urban regions (the areas around Louisville, Lexington, and Northern Kentucky) and eleven that range from small urban to rural environments. Four regions are largely Appalachian and four regions are Midwestern in character. Traumatic brain injuries can be analyzed by region to examine broader regional characteristics as well as rural and urban differences.

Study Method

This study of the prevalence of brain injury among Kentucky household members builds on epidemiological approaches used in identifying the incidence and prevalence of brain injury (Sosin, Sniezek & Thurman, 1996; Thurman, 2001). The primary focus of research on brain injury in the general population has been on injury incidents rather than the prevalence of persons with a history of brain injury. Rather than relying on clinical samples with diagnosed brain injury, this study examines self-reported head injuries among Kentucky household members. The study uses telephone interviews with household members to learn about the presence of a history of head injury among household members. Ideally, face-to-face interviews should be used in order to obtain more in-depth information and to obtain information from households without telephones. While funding constraints limited this study to telephone interviews, telephone surveys have been used extensively in epidemiological studies to examine health problems. The specific approach used in this pilot study was a telephone survey from the total households in Kentucky. Cell telephone numbers were not included. Telephone numbers were selected using randomized digit dialing – a process that ensures randomization of households by region.

The study was reviewed and approved by the University of Kentucky Medical Institutional Review Board (IRB). The protocol includes a script at the beginning of the calls which discussed the study and process. The interviewers offered respondents information about the study as well as risks or benefits from participating. Participants were informed that they could terminate the interview at any point or not participate at all. Participants received no incentive for their participation in the study. In addition, this telephone survey asked the adult person answering the telephone to respond to the questions about individuals with head injury in the household rather than speaking to the person with the brain injury. There were two reasons for this approach: 1) Many individuals with brain injuries are unable to give accurate information about their injuries and related problems; and 2) The purpose of the survey was not to collect clinical information, but to develop estimates of the number of households with head injuries.

The survey questions used the term “head injuries” rather than “brain injuries” since brain injury is a diagnosed condition whereas head injury is an experienced event. People may or may not know whether they have had a brain injury, but they are able to recount a head injury. Head injuries may or may not result in brain injuries. This is one of the reasons for including follow-up questions about

problems that were experienced post injury. Given current research on the effects of mild brain injuries (Kelly, Johnson, Knoller, Drubach & Winslow, 1997; Malec, 1999), brain injury can be inferred from head injuries that have subsequent problems in emotion, memory, and other behavioral problems. Also, previous studies have used head injury as a proxy for brain injury (Sosin, et al, 1996).

Sample selection was developed by the University of Kentucky Survey Research Center under the direction of Ronald E. Langley, Ph.D. Interviewers were trained by Robert Walker, the Principal Investigator for this study, and by Dr. Langley. The interviews began in November 2002.

The Survey Research Center used the WinQuery Computer-Assisted Telephone Interviewing (CATI) system, a 22-line telephone bank, and 28 computer workstations. The full-featured CATI system enables the interviewer to enter responses to each question directly into the computer. CATI provides automatic skips, preprogrammed prompts, and the routine coding of all open-ended questions. All data are entered in the computer-assisted telephone interviewing (CATI) system at the time of the interview, allowing for constant monitoring of productivity and quality. CATI logged all attempted calls and provides an automatic scheduling algorithm to ensure that phone numbers were attempted at different hours on different days until contact is made.

Survey Items

Since this survey was not intended to obtain a complete in-depth set of clinical information on persons with brain injuries, but to collect prevalence information. The survey was two-tiered with basic demographic information including household size of children and adults and county of residence, and a question focused on whether any household member had ever received a head injury. Respondents who stated "no" to this question satisfied the interview and the call was ended with the respondent was thanked for participating. Respondents who answered "yes" to this question were then asked several other questions. In order to identify respondents with more severe injuries, several follow-up questions were used. These questions were used to help clarify characteristics of the injury that are associated with more severe injuries. While these questions examined potential indicators of severity, they were not diagnostic. These questions included asking about emergency room visits, staying at least one night in a hospital, experiencing changes in behavior following the injury, and using professional services as a result of the injury (Guerrero, Thurman & Sniezek, 2000; Malec, 1999). These constructs served as indicators of severity by focusing on selected consequences of mild brain injury. For example, having been in a hospital may be an indicator of severity of brain injury. However, almost half of the disability days related to brain injury occur among person who were not hospitalized (Fife, 1987). Sequelae to brain injury can also indicate longer term severity of injury as well as a need for services for the injured person. In addition, asking about changes in personality or mood can provide information about the severity and

service needs of the injured person. Depression and anxiety are also common among persons with brain injury including mild injury (Hibbard, Uysal, Kepler, Bogdany, & Silver, 1998: Mateer, 2000). A question was included about the need for substance abuse counseling following the injury. This question was included because of the literature on associations of brain injury with substance use (Kelly et al. 1997; Miller 1992; Solomon & Sparadeo 1992; Sparadeo, Strauss & Kapsalis 1992; Sparadeo & Gill 1989).

Data Analysis

Responses from each call were entered electronically into a database as the interview was conducted. Data were submitted to the Principal Investigator and converted to an SPSS database for analysis. Frequencies were run for each of the variables in the survey. Data were analyzed by mental health region because (1) Kentucky House Bill 843 initiated a renewed needs assessment for mental health, mental retardation, and substance abuse treatment services for each region of the state; and (2) the Cabinet for Health Services Brain Injury Services Unit was established in the Department of Mental Health and Mental Retardation which uses regional plans for services. Hence, the mental health regions were used as geographic units to analyze for regional differences in brain injury prevalence rates. In addition, data were analyzed by region and compared to the regional distribution of the Kentucky population from the 2000 census in order to examine statewide representativeness.

Results

This preliminary report of findings includes data from 1,616 households that have been contacted by mid-January 2003. The response rate for completing the telephone interview was 51.1% of all attempted calls with only an 11.4% refusal rate. Almost twenty-six percent (25.8%) of the calls were to numbers that had been disconnected. Another 22% had a variety of reasons for incompletion of the interview including caller ID blocking, language problems, no answer, or the line was busy on all attempts. By the end of the study, it is estimated that at least 3,000 households will be contacted.

The distribution of households by region of the state is shown in Table 1. Table 1 shows the 2000 Kentucky population for each region and each region's percent of the state population as well as the number of households contacted by region with their percents to total as well. At the present, the proportion of households contacted in region 6 (Louisville) is lower than the region's proportion of the state population. This difference approaches significance ($p < .05$). The distribution of calls for the other twelve regions is consistent with the distribution of regional population. There were 12 counties listed that did not conform to any identifiable county in the state and were not included in the regional analysis. Table 1 also shows households contacted compared with regional population.

Table 1. Total Households Contacted by Mental Health Region Compared with Regional Population
(n=1604)

Mental Health Region	Number Contacted	Percent	2000 Census Regional Population	Percent of Total State Population
1 Four Rivers – Paducah	98	6.1	203,299	**5.0**
2 Pennyroyal – Hopkinsville	77	4.8	205,715	**5.1**
3 Valley – Owensboro	97	6.0	207,377	**5.1**
4 Lifeskills – Bowling Green	90	5.6	255,225	**6.3**
5 Communicare - Elizabethtown	93	5.8	243,202	**6.0**
6 Seven Counties – Louisville	300	18.7*	869,306	**21.5**
7 NorthKY – Covington	150	9.4	391,417	**9.7**
8 Comprehend - Maysville	18	1.1	55,229	**1.4**
10 Pathways – Ashland	88	5.5	212,086	**5.2**
11 Mountain – Prestonsburg	49	3.1	160,532	**4.0**
12 Kentucky River – Jackson	33	2.1	120,656	**3.0**
13 Cumberland River – Corbin	114	7.1	238,270	**5.9**
14 Adanta – Somerset	94	5.9	193,452	**4.9**
15 Bluegrass - Lexington	303	18.9	686,003	**17.0**
Total	1604	100.0	4,041,769	**100.1**[a]

* $p<.05$
[a] Sum over 100% due to rounding

Table 2 shows the regional distribution of households that reported at least one person with a head injury. The table also presents the 2000 census population for each region. The distribution of households with persons with brain injuries is consistent with regional population distribution, suggesting that there are no significant regional differences in prevalence. There were 321 households with at least one person reported with a brain injury. However, one household had no county data available.

Table 2. Mental Health Region for persons with a brain injury (n=320)

Mental Health Region	Households with Injured Persons	Percent of total	2000 Census Regional Population	Percent of Total State Population
1 Four Rivers – Paducah	17	5.3	203,299	**5.0**
2 Pennyroyal – Hopkinsville	13	4.1	205,715	**5.1**
3 Valley – Owensboro	22	6.9	207,377	**5.1**
4 Lifeskills – Bowling Green	13	4.1	255,225	**6.3**
5 Communicare - Elizabethtown	30	9.4	243,202	**6.0**
6 River Region – Louisville	61	19.1	869,306	**21.5**
7 NorthKY – Covington	26	8.1	391,417	**9.7**
8 Comprehend - Maysville	5	1.6	55,229	**1.4**
10 Pathways – Ashland	18	5.6	212,086	**5.2**
11 Mountain – Prestonsburg	10	3.1	160,532	**4.0**
12 Kentucky River – Jackson	8	2.5	120,656	**3.0**
13 Cumberland Valley – Corbin	21	6.6	238,270	**5.9**
14 Adanta – Somerset	23	7.2	193,452	**4.9**
15 Bluegrass – Lexington	53	16.6	686,003	**17.0**
Total	320	100.0	4,041,769	**100.1**[a]

[a] Sum over 100% due to rounding

Table 3 shows the number of households reporting a member with a brain injury and the number of injured persons in that household. Specifically, 321 households reported at least one person with a history of a brain injury. In other words, 19.9% of the contacted households reported having at least one person with a brain injury. Surprisingly, 69 households reported more than one household member with a brain injury. This means that of the 19.9% of households that reported at least one member with a brain injury, 4.3% of all households, or 21.5% of households with brain injuries among it members, reported having more than one person with a head injury. The average household size in this study was 2.66, which is slightly larger than the statewide average of 2.47 – a difference that approaches significance ($p<.05$). Some of the households reported a unusually large number of members which may contribute to this disparity.

Table 3. Households by Number of Members with Brain Injury (n=321)

Households with One or More Persons With a Brain Injury	Number of Households with This Number of Injured Persons	Percent of Total Households
Households with 1	252	15.6
Households with 2	58	3.6
Households with 3	9	.6
Households with 4	2	.1
TOTAL HOUSEHOLDS WITH PERSONS WITH INJURIES	321	**19.9**

Following the information about households with persons with head injuries, data were collected about the persons who had injuries while they were in those households. While there were 321 households reporting at least one injured person, the total number of injured persons was 403. Table 4 presents the current living situation of the person who was reported as having a head injury. The majority of the injured persons are still living in the household (86.1%) and only 11.4% were reported as living elsewhere. Less than three percent (2.4%) were reported as having died from either the head injury or other causes. This leaves 393 living individuals reported with a head injury who have other reported data about the consequences of their injury.

Table 4. Where the Injured Person Lives (n=403)

Injured persons still living in the household	Number of Injured Persons	Percent
Person still living in the household	347	86.1
Person living elsewhere	46	11.4
Person died as a result of the injury	7	1.7
Person died of other causes	3	.7

Table 5 presents the gender of persons who were identified with a head injury. In this study, 62.3% of the injured persons were male. There was a slightly higher rate of injury for females than is reported in national mortality data with 73% of brain injury deaths being male (Adekoya, 2002). However, emergency department studies of brain injury have the same distribution of male (61%) to female (39%) patients (Guerrero, Thurman & Sniezek, 2000). The data in that study include mild head injuries as well as fatal injuries and this may explain the different proportion of female injured persons.

Table 5. Gender of Injured Persons (n=403)

Injured persons	Gender of Injured Persons	Percent
Male	251	62.3
Female	152	37.7

Table 6 shows the age of the person at the time of the head injury. Over half (59.8%) of the injuries occurred among persons under age 21, a finding that is consistent with other incident data (Guerrero, Thurman & Sniezek, 2000). The prevalence of reported head injuries among Kentucky households decreased among older persons with the over 50 year-old group reported at only 7.4% of the total head injured persons.

Table 6. Age at the Time of the Head Injury (n=403)

Injured persons still living in the household	Number of Injured Persons	Percent
Under age 21	241	59.8
Between the ages of 21-30	63	15.6
Between the ages of 31-40	40	9.9
Between the ages of 41-50	28	6.9
Over the age of 50	30	7.4
Did not answer	1	.2

Table 7 presents the reported causes of head injuries. Motor vehicles represented about one-third (33.5%) of the reported causes and sports accounted for 15.6% of the injuries. Only 3% of the injuries were from assaults or fights, while falls accounted for 24.6% of the injuries. Failure to use a helmet was only cited in 11.4% of the cases, and failure to use a safety belt was reported in only 9.1% of injuries.

Table 7. Causes of Head Injury (n=403)

Cause	Number of Injured Persons	Percent
Motor vehicle accident	135	33.5
Sports or other recreational activity	63	15.6
Work-related accident	28	6.9
Assaults or fights	12	3.0
Falls	99	24.6
Other	66	16.4
Additional factors associated with the injury -		
Cases not using a helmet	46	11.4
Cases not using a safety belt	37	9.1

Table 8 provides information about the immediate consequences of the reported head injury and post injury loss of consciousness. Loss of consciousness is one indicator of brain injury severity. Data were available for 397 of the reported injured persons. Close to half (43.4%) of the cases involved a loss of consciousness following the injury.

Table 8. Loss of Consciousness (n=397)

Loss of Consciousness	Number of Injured Persons	Percent
Person **lost** consciousness	175	44.1
Person did **Not** lose consciousness	212	53.4
Unsure, do not know	10	2.5

Use of an emergency department for health assessment or treatment following a brain injury can be an indicator of brain injury severity. Data on this measure were available for 393 injured persons who

survived the injury. Table 9 shows that 84.1% of the persons reported with a head injury were taken to an emergency department following the injury.

Table 9. Use of Emergency Department (n=393)

Did the person go to an ER	Number of Injured Persons	Percent
Yes	331	84.2
No	59	15.0
Unsure	3	.7

Another indicator of brain injury severity is hospitalization following the injury. In these preliminary findings, Table 10 shows that 41.6% of the persons who were reported with a head injury stayed in a hospital at least one night.

Table 10. Hospitalization (n=334)

Was the person kept in a hospital for at least one night	Number of Injured Persons	Percent
Yes	139	41.6
No	193	57.8
Unsure	2	.7

Table 11 presents the changes in mood or personality after a head injury. Among the 403 persons who were reported as having had a brain injury, the 393 who survived the injury had information about changes in mood or personality after the injury. Over one-third (39.4%) had at least one change in mood or personality following the injury. Over one-fifth (21.6%) were reported with increased depression following the injury and 22.8% had increased anxiety. Almost the same number (21.1%) were reported with changed personality traits. Almost one-fourth (23.7%) had memory problems following the injury. Surprisingly, only 4.6% were reported to have increased substance use following the injury.

Table 11. Changes in Mood or Personality (n=393)

Changed Trait	Number of Injured Persons	Percent
Persons reported with increased depression	85	21.6
Persons reported with increased anxiety	88	22.8
Persons reported with changed personality traits	83	21.1
Persons reported with increased substance use	18	4.6
Persons reported with increased memory problems	93	23.7
Total persons reported to have at least one of the above problems	155	39.4

Figure 1 presents the four most frequently reported changes in personality or mood after the injury. These changes were not exclusive choices among respondents. Hence, persons with increased depression may also have experienced increased memory problems.

Figure 1. Most Reported Changes/Increased Problems after the Head Injury (n=393)

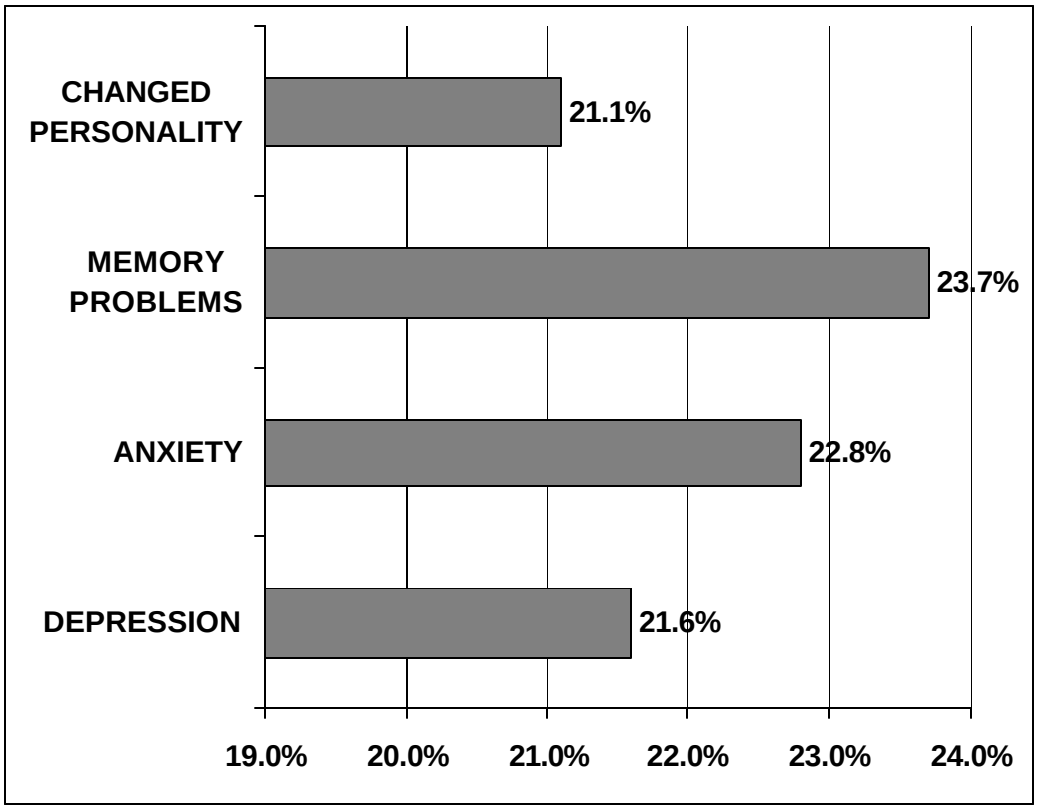

Table 12a presents the number of persons who needed professional services after the injury. Almost one third (32.6%) of the injured persons needed professional services after the injury. The specific services are shown in Table 12b which includes persons and type of services needed as a percent of those who needed professional services. Over one-fourth (25.8%) needed mental health services and 27.3% needing specialized equipment. Almost one half (42.2%) needed physical therapy, occupational therapy or speech therapy. A much smaller number (5.3%) were reported as needing vocational training. Over one fifth (21.1%) needed residential treatment or rehabilitation. Environmental modifications were needed by 16.4% of the injured persons and 41.4% needed other medical services.

Table 12a. Use of Professional Services (n=393)

Did the person need professional services	Number of Injured Persons	Percent
Yes	128	32.6
No	262	66.7
Unsure	3	.7

Table 12b. Use of Professional Services: Specific Services (n=128)

Type of professional services needed	Number of Injured Persons Needing Services	Percent of persons needing services
Mental health services	33	25.8
Specialized equipment	35	27.3
Physical therapy, speech or occupational therapy	54	42.2
Vocational training	17	13.3
Substance abuse counseling	1	.8
Personal care assistance	25	19.5
Environmental modifications	21	16.4
Residential treatment or rehabilitation	27	21.1
Other medical services	53	41.4

Table 13a and 13b show a loss and return to work or schooling. Almost one half (44.0%) of the injured persons were reported as having lost a job or school placement after their injury. However, over three-fourths (82.6%) were able to return to work or school.

Table 13a. Did the injury result in a loss of work or being unable to go to school (n=393)

Did the person lose a job or schooling	Number of Injured Persons	Percent
Yes	173	44.0
No	220	56.0

Table 13b. Has the injured person returned to work or school (n=173)

Was the person able to return to work or school	Number of Injured Persons	Percent
Yes	143	82.6
No	30	17.4

Discussion

These preliminary findings of the prevalence of brain injury in Kentucky represent a departure from the predominant epidemiological studies of brain injury in the United States. Most states, along with the Centers for Disease Control have focused on the incidence of brain injury by examining hospital and emergency department records. This study marks a new direction in brain injury research by examining the prevalence of reported head injuries among households in one state. In addition, the study, once completed, will provide information about possible differences in prevalence and injury sequelae between rural and urban areas.

With more persons surviving brain injuries, it is all the more important to have estimates of the persons who might require health, mental health, substance abuse treatment, and rehabilitation for problems related to brain injuries. Incidence data alone will not help health planners in identifying the number of persons in the population with these needs. The range of brain injury sequelae includes increased substance use, increased depression and anxiety, as well as memory problems and other problems that were not addressed by this brief survey. However, these preliminary findings suggest that key sequelae an be identified and may be useful indicators of brain injury severity. The identification of 19.9% of the households with one or more persons with a brain injury is an important contribution to the understanding of health problems in Kentucky and may be an important step toward a better epidemiology of brain injury.

There are several implications from this survey. Health planners and providers may need to be more cognizant of brain injury-related problems as they plan or implement interventions. The preliminary findings from this pilot study suggest that brain injury is more prevalent than expected. In addition, the findings about problems experienced by people after the injury support recent research about the long-term effects of mild brain injury. Since only about half of mild brain injury incidents result in medical care and may only receive outpatient clinic treatment (Torner, Choi & Barnes 1999), it is important to examine more than hospital discharge data to estimate the scope of the brain injury problem. Mild brain injury has continued to present a challenge for health care planners since it is difficult to obtain data about its prevalence. This can be all the more difficult since the acute and chronic sequelae of mild brain injury such as severe memory deficits are less severe and less immediately observable. More importantly, the current understanding of brain injury sequelae includes the possibility of recovery long after the injury (Prigatano, 1999). Some of the problems resulting from brain injuries can develop long after the injury and recovery of functions can occur with focused rehabilitation even years after an injury (Mateer, 2000; Prigatano, 1999). The recent research and clinical attention to mild traumatic brain injury (Malec, 1999) suggests a continuing need for research among the general population in addition to clinical populations in trauma centers and acute rehabilitation.

Limitations

This pilot prevalence study has many limitations. First, it uses households that have telephones, thus excluding many persons or households that do not have telephones. This may diminish generalizability of findings because households without telephone might have higher or lower head injury rates. The study did not select individuals with diagnosed brain injuries and this may mean that persons were reported with head injuries without subsequent brain injury. Brain injured persons may or may not be reliable informants about their history and condition. Also, this study excluded many other questions that could have been potentially interesting due to financial constraints. One of the sacrifices for the study was to reach a large sample with a short interview rather than a small sample with a long interview. This study sought a larger sample in order to achieve the broader findings about the prevalence of brain injury among Kentuckians. Also, while this study examined selected consequences of head injury that can indicate injury severity, the study did not assess the severity of brain injury or disabilities among subjects. Hence, the findings do not address differences in need between persons with severe and mild brain injury.

Conclusion

These preliminary findings represent one of the first efforts in the nation to survey the general population to obtain prevalence estimates of brain injury. The finding of 19.9% of households having one or more persons with a history of a head injury is a surprising one. In Kentucky, the 2000 Census identified 1,590,647 households. These preliminary findings suggest that statewide, there could be 316,539 households with at least one member with a head injury ranging from mild to more severe injuries. Also from these findings, it could be estimated that approximately one-third of the injured persons (104, 458) would require professional services following the injury. Over one-fifth (21%, or 66,473 persons) would experience increased depression and/or anxiety resulting from their injuries. These preliminary findings suggest that the ever increasing number of persons in the Kentucky population with a brain injury may represent a growing problem for health care planning. Brain injury may be contributing to service demand and to problems in living long after the acute phase pf the injury and after acute medical and rehabilitation services. Future research with household populations should examine brain injury in more detail in order to better understand the scope and extent of injuries on people's lives.

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